Total No. of Questions : 10]

SEAT No. :

P2154

[Total No. of Pages : 4

[5254] - 550
B.E. (Mechanical)
FINITE ELEMENT ANALYSIS
(Elective - IV) (2012 Pattern)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Draw suitable neat diagrams, wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of electronic pocket calculator is allowed.***
4) ***Assume suitable data, if required.***

Q1) a) Write short notes on : **[6]**

i) Effect of element aspect ratio on accuracy.

ii) Mesh refinement vs higher order elements.

b) Discuss the advantages and disadvantages of FEM over **[4]**

i) Classical method

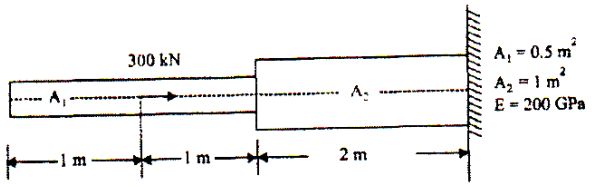
ii) Finite difference method

OR

Q2) a) Explain the principle of Rayleigh - Ritz method. **[6]**

b) Explain plane stress formulation and its importance. **[4]**

Q3) Determine the nodal displacements and element stresses by finite element formulation for the following figure. Use P = 300 kN; A_1, = 0.5 m^2; A_2 = 1 m^2; E = 200 GPa **[10]**



OR

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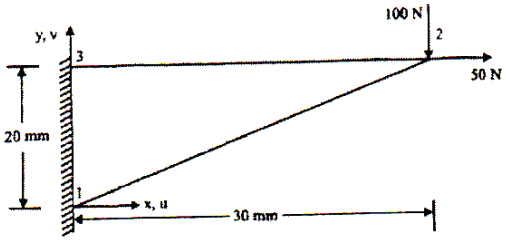
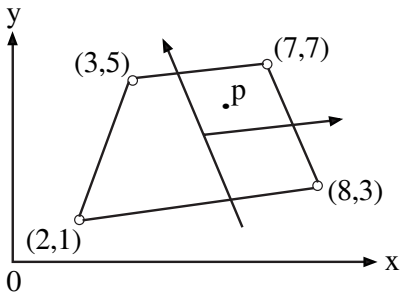
Q4) a) Calculate displacements and stress in a triangular plate, fixed along one edge and subjected to concentrated load at its free end. Assume E = 70,000 MPa, t = 10 mm and v = 0.3 **[6]**



b) What is meant by displacement function? Write down convergence criteria for Finite element Analysis. **[4]**

Q5) a) Explain the isoparametric concept in finite element analysis. **[6]**

b) Determine the Cartesian coordinate of the point P($\zeta = 0.25$, $\eta = 0.5$) shown in fig. **[6]**

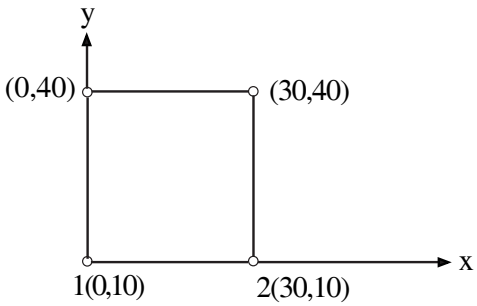


c) State and explain the three basic laws on which isoparametric concept is developed. **[6]**

OR

Q6) a) Explain the terms isoparametric, subparametric and superparametric elements. **[8]**

b) For the element shown in fig. assemble Jacobian matrix and strain displacement matrix for the Gaussian point (0.2578, 0.6550). **[10]**



Q7) a) Write down governing equation of steady state Heat Transfer and also write down elemental stiffness matrix and compare with Bar element. **[6]**

b) Consider a brick wall of thickness 0.6 m, k = 0.8 W/m°K. The inner surface is at 28°C and the outer surface is exposed to cold air at - 10°C. The heat transfer coefficient associated with the outside surface is 40 $W/m^{2^\circ}k$. Determine the steady state temperature distribution within the wall and also the heat flux through the wall. Use two elements and obtain the solution. **[10]**

OR

Q8) a) Heat is generated in a large plate (K = 0.4 W/m °C) at the rate of 5000 W/m^3 The plate is 20 cm thick. Outside surface of the plate is exposed to ambient air at 30°C with a convective heat transfer coefficient of 20 $W/m^{2^\circ}c$. Determine the temperature distribution in the wall. **[10]**

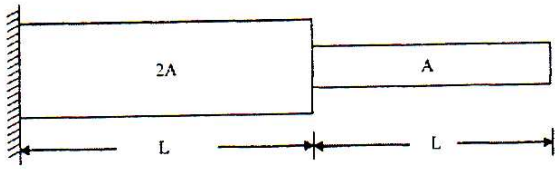
b) Derive FEA stiffness matrix for Pin Fin Heat Transfer problem. **[6]**

Q9) a) Write down Consistent mass and Lumped Mass Matrix for **[6]**

i) Bar Element

ii) Plane Stress Element

b) Find the natural frequencies of longitudinal vibrations of the same stepped shaft of areas A = 1000 mm^2 and 2A = 2000 mm^2 and of equal lengths (L = 1m), when it is constrained at one end, as shown below. **[10]**

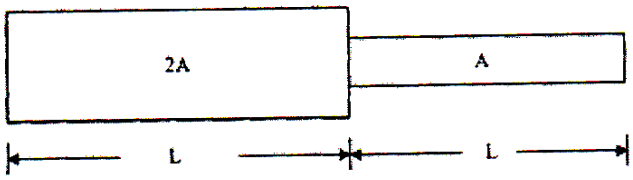


OR

Q10) a) Explain Each term of Dynamic Equation given below and explain importance of eigen values and eigen vectors. **[6]**

$$m\ddot{x} + c\dot{x} + kx = f$$

b) Find the natural frequencies of longitudinal vibrations of the unconstrained stepped shaft of areas A and 2A and of equal lengths (L), as shown below. **[10]**



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